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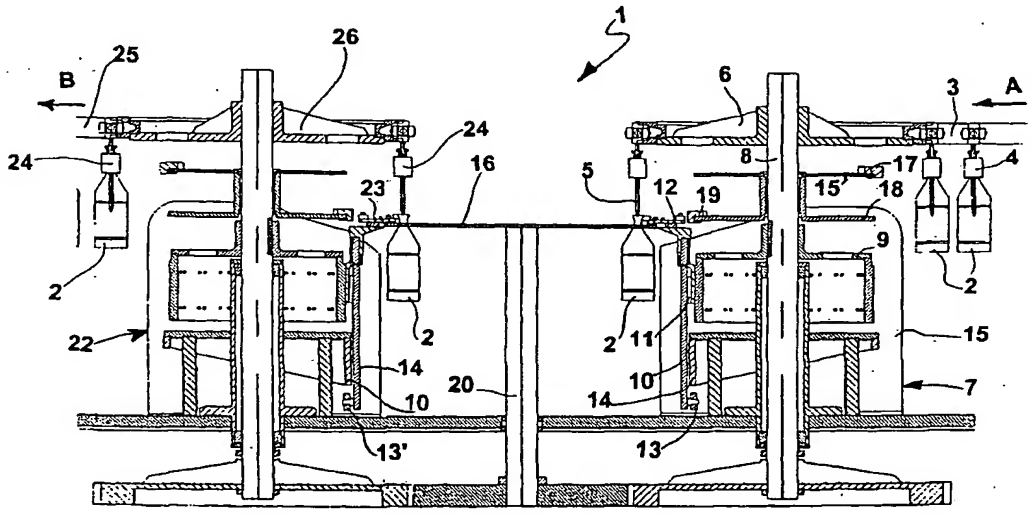
(54) Title: DEVICE FOR TRANSFERRING CONTAINERS BETWEEN CONVEYORS



(57) Abstract: Device for transferring (1) plastic bottles (2) comprising a first wheel (7) for unloading the bottles from a first conveyor chain (3) at a first station. The transferring device is equipped with holders and a cam-type device for detaching the bottles from the first chain, removing them from the holding elements, (4) and lowering them to the level of a second transfer wheel (16). This wheel is equipped with holders (2) that seize the bottles from the first wheel (7), and transfer them to a second wheel (22) where they are held by means of holders (23) and placed at the level of the second conveyor chain (25). Here, the bottles are inserted in other holding elements (24) and transported to the next station.

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DEVICE FOR TRANSFERRING CONTAINERS BETWEEN CONVEYORS

Technical field

This invention relates to a device for transferring containers, for example plastic bottles. More particularly, it relates to the transfer between different segments of a conveyor or between different conveyors in container production or treating plants.

Prior art

Today, the production of containers in different shapes and sizes – for example, plastic bottles or pots made of PET, PP, HDPE, or PEN – takes place in large-scale production plants that carry out more or less complex production processes involving a series of steps. Normally, these steps include at least a blow-moulding phase to create the container in its final form, starting from a pre-moulded workpiece produced by means of injection or other type of moulding.

Depending on the type of container, the blow-moulding phase may be followed by a coating operation using products particularly suited to make the container gas-tight, such as to oxygen or carbon dioxide, or less sensitive to light, or to decorate the container.

Since production plants able to carry out a large number of operations and production processes per hour are evermore requested, the plants must comprise segments where the corresponding steps of the production process of the final container are carried out starting from the pre-moulded workpiece produced by means of injection, compression, or other type of moulding.

To accomplish this, each of said segments is provided with a conveying system for transporting the containers, regardless of their status (pre-mould, semi-finished product, or finished container). The conveying system of the entire plant can consist of a single circuit served by one conveyor or multiple circuits served by different conveyors; for example, a chain where holding devices are hung, a conveyor belt, etc. forming closed circuits, or combinations of different systems. In the case in which multiple devices or separate conveying circuits are present in the production plant, the type of conveyor is chosen also as a function of the particular phase of the production process that must be carried out at the station of the plant. The choice is made based on matters such as the objects to be transported, for example, pre-moulds, semi-finished products, or finished

containers, and the condition of the objects, for example, if the containers are hot or cold, if they are covered with fresh paint or reticulated paint, etc.

An example of a demanding production process is the production plants of bottles containing water or drinks; these plants have a productive capacity that can equal several thousand bottles per hour, and can include special painting or coating processes for protective or decorative purposes. In these plants, the feed rates of the conveyors are very high with the consequent need to have, in every segment of the conveying path, reliable devices able to satisfy all the functions.

If the production plant of containers requires, for whatever reason, several separate circuits of conveyors, it is necessary to install devices for transferring the containers from one conveyor to another (for example, from one chain to another). These transferring devices must satisfy very stringent operating conditions, and are subject to particularly high stress when the conveying speed of the bottles is high. The operation of said transferring devices must be very reliable: the containers must be gripped securely and must not be dropped or damaged since this could lead to the stoppage of the entire plant, resulting in possibly considerable economic losses.

A particular problem arises for devices that must grip and transfer containers covered with fresh paint or other products from one conveyor to the next conveyor. In this case, if the wet surface comes into contact with another object, obstacle, or element of the structure of the plant, the coated surface is damaged, and the product must be rejected. State-of-the-art solutions proposed in the past to keep the containers in an axially rigid position (i.e. without producing undesirable oscillations that can lead to undesirable contacts) during the transfer from one conveyor to the next have not produced satisfactory results for plants with a high output of bottles.

The known solutions involve gripping the containers with very rigid holding means, which do not allow the bottle to sway undesirably; however, these holding means, the so-called chucks, involve container-releasing mechanisms that are activated by problematic movements.

Objects of the Invention

It is an object of this invention to provide a device for transferring containers or other similar objects, especially plastic containers, that resolves the aforementioned problems. This transferring device must be able to transfer containers from one conveyor to the next at high feed rates; must release and grip the containers again in a reliable manner, even if the containers are coated with paint or other similar products for protective or decorative reasons without the still-wet area of the containers coming into contact with foreign elements; and must grip the containers in limited and well-defined areas.

It is another object of the invention to create a transferring device that is modular and can be used entirely or partially in various stations of the production plant: for example, for loading the containers onto the conveyors, and unloading them from the conveyors.

These objects, in accordance with a first aspect of the invention, are achieved by means of a device with an open end for transferring containers from a first continuous chain conveyor to a second continuous chain conveyor, which is different from the first. Said first and second conveyors are equipped with holding elements suitable to secure reversibly said containers at their open end in a vertical position with an inserting/removing movement. Said transferring device comprises a first, second, and third star wheel with reciprocally parallel and vertical rotary axes; each wheel, is equipped with multiple holders for grasping said containers. Said first star wheel includes means suitable to move its holders vertically from a higher position, substantially equal to the moving plane of said first conveyor, to a lower position at the level of said second star wheel in order to remove said containers axially from the respective holding elements of said first conveyor. While, said third star wheel includes means adapted to make its holders move vertically between said lower position at the level of said second star wheel and a higher position, substantially equal to the moving plane of said second conveyor, in order to insert said containers axially into the respective holding elements of said second conveyor.

Thanks to the innovative characteristics of the device in accordance with this invention, it can be used in production plants that reach production levels of even 30,000 bottles per hour and where a coating process is carried out.

The device can achieve the aforesaid high container-unloading and/or loading speeds from/to conveyors of the chain type fitted with container-holding elements or chucks that have a particular shape, are particularly suited to coating plants, and may comprise moving or fixed protective sheaths to protect the chucks and certain areas of the bottles (such as the threaded neck from the paint.

The realization of a transferring device that is versatile, has a simple structure, is able to operate with chucks equipped with bottle-holding and releasing mechanisms (even complex, and can be used in high speed bottle production plants has the advantage of separating the conveying lines of the containers. In this way, it is possible to isolate the area of the production plant where the coated containers are wet from one or more areas where the containers are dry or drying. Dividing the plant into areas leads to benefits and savings in terms of construction and management costs. In fact, the dry area, which is usually larger, can be served by simpler, and hence less expensive, container-holding devices or chucks, while the more complex chucks can be used in the wet area. Furthermore, the shorter chain of the wet area, after being freed from the bottles, can be made to travel through a cleaning station while the paint residues are still wet, greatly facilitating cleaning.

Brief description of the drawings

Other advantages of the invention will be readily apparent from the more detailed description of a particular version of the device, described by way of a nonlimiting example by means of the following figures:

- **Fig. 1 shows a plan view of a device for transferring containers in accordance with this invention**
- **Fig. 2 shows a cross section according to the S-S line of the device of Fig. 1**

Detailed description of the invention

Figures 1 and 2 show a device of the invention, hereinafter also referred to as reference 1, for transferring containers found in a bottle production plant. The containers described below and shown in the relating drawings are plastic bottles (for example, PET; however, the device of the invention also applies to containers in different shapes and materials. This description applies to the device 1 installed

in a coating plant positioned, for example, after a known blow-moulding plant for making bottles, which will not be described further. The bottles 2 are transported to a loading station of the coating plant by means of a conveyor, of the chain or belt type, that conveys the bottles at a predetermined feed rate, depending on the technical particulars and the productive capacity of the plant. The bottles 2 are grasped by holding elements 4, the so-called chucks, fastened to a chain 3 that moves in the direction of the arrow A, which defines a closed conveying circuit that provides the bottles to the coating station.

The device 1 for transferring the containers from the conveyor chain 3 of the invention is positioned, for example, at the outlet of the coating station of the production plant; the bottles come out of the station covered in fresh paint. When used in a fresh-paint environment, the bottles are hung up on the conveyor chain through chucks 4 specifically equipped with protective elements in order to prevent the paint from entering the delicate mechanisms of said elements and making them stick, or contaminating the threaded area of the bottle neck where no paint or coating is required. Often, the coating station requires a chuck equipped with an electrode 5, which sticks out of the chuck and reaches inside the bottle in order to generate the appropriate electrostatic charge required to optimize coating. The additional obstacle in the form of said electrodes makes it necessary to lower the bottles vertically further in order to remove them from the chucks that hang them.

The chain 3 is wound around a coaxial wheel 6, and is placed at a higher level than the first unloading carousel 7 of the bottles. The wheel 6 is fitted onto a driving axis 8 that transmits the rotary movement of the carousel. A supporting element 9 in the form of a drum is fastened solidly and concentrically with the axis 8. On the perimeter of the drum 9, vertical guides 11 are arranged in which the rods 10 slide vertically, in a direction parallel to the driving axis 8. At the top end of each rod 10, a holder 12 is placed to grip and transfer the bottles by the neck. The rods 10 are positioned equidistantly around the drum 9; their position is equal to the pitch of the supporting elements on the chain 3. At the bottom end, the rods 10 are equipped with a roller 13, or similar element, that is responsible for following the contour of a cam 14 in a ring-type shape fixed solidarily to the structure of the device and concentric with the axis 8. The cam 14, acting on the roller 13 during

the rotation of the drum 9, makes the holder 12 slide vertically between the lower position shown in Fig. 2 on the left of the carousel 7 and the higher position on the right of the carousel.

The carousel comprises two fixed disks 15, 18; these disks are coaxial with the driving axis 8 and support the cams 17, 19 that act on the mechanisms for opening the holders 12 when these are located, during their circular path, in the segment where they must grip or release the bottles. It is possible to use other types of holder opening and closing means for example, mechanical, electric, and hydraulic, and still remain in accordance with the invention.

Preferably, a protective cover 15 is required around the carousel 7 in order to cover some moving parts, preventing accidents and damage.

During the operation of the transferring device, when the holders 12 are in their raised position, during the rotation of the carousel 7, they grip the bottles by the neck, where the paint was not applied, and remove them from the respective chuck 4 that keeps them attached to the chain 3. As the rotary movement of the carousel 7 around the axis 8 continues, the holders transport the bottles 2 vertically downward to the lower position. During the vertical downward movement, the bottles disengage the electrode 5 and can be transferred to the holders, not shown in the figure, fastened around the perimeter of the tranfer wheel 16. These holders grip the bottles by the neck and transfer them to the transfer wheel 16, which also is provided with a rotary movement transmitted by a vertical axis 20. These holders are positioned equidistantly around the perimeter of the wheel 16 and can be opened through opening mechanisms for inserting or releasing the bottles. It is also possible to include an opening mechanism activated when the neck of the bottle is pushed by the holders 12 of the carousel 7; this can then snap closed under the action of springs, holding the bottles in place.

Transported by the rotation of the wheel 16 to the position of the carousel 22, which is structurally similar to carousel 7, the gripped bottles, which are still held in the holders of the transfer wheel 16, are gripped by the holders 23. Then, in the way already explained for the carousel 7, the bottles are removed from the holders of the transfer wheel, moved upward vertically thanks to the rotation of the carousel 22, and are brought back to the level where they can be gripped by the

chucks 24 fastened to the conveyor chain 25 wound around the wheel 26 coaxial with the carousel 22. In this case, the chucks can be equipped with electrodes or not, depending on whether a particular electric charge must be generated for the bottles.

The unloading carousel 7, the loading carousel 26, and the transfer wheel 16 are rotated by means of known rotary means electric, mechanical, or hydraulic, and also comprise means for synchronizing the feeding of the chains 3, 25.

After being gripped by the chain 26, the bottles are transferred, for example, to an evaporating or drying station, or to another station required in the production process. After going through the next one or more steps, the bottles are unloaded from the chain or transferred to other circuits for other uses or to undergo other operations. The conveyor chain 3, after passing through the cleaning station returns, for example, to the coating station where other bottles to be coated are loaded continuously.

From the above description, it is obvious to the person skilled in the art that this transferring device can be used anywhere where bottles must be transferred from one conveyor chain to another conveyor at any station of a bottle production plant.

CLAIMS

1) A device (1) for transferring open-ended containers (2) from a first (3) to a second (25) continuous chain conveyor, where said first and second conveyors are equipped with respective holding elements (4, 24) adapted to fasten reversibly said containers (2) at their open end in a position that is substantially vertical with an insertion/removal movement; said transferring device (1) comprises a first (7), second (16), and third (22) rotary element, with parallel and vertical rotary axes, equipped along its respective perimeter with several holders (12, 23) for gripping said containers (2), where said first rotary element (7) comprises means (10, 13, 14) for moving its respective holders vertically during the rotation of the rotary element (7) from a higher position, substantially equal to the feed plane of appropriate gripping areas of the containers (2) when they are fixed to said first conveyor (3), to a lower position equal to the level of said second rotary element (16) in order to move said containers (2) vertically and remove them from said respective holding elements (4) attached to said first conveyor and where said third rotary element (22) comprises means (10', 13', 14') for moving its respective holders (23) vertically during the rotation of the element from a lower position, at the level of said second rotary element (16), to a higher position, substantially equal to the feed plane of the appropriate gripping areas of the containers (2) when they are fixed to said second conveyor (25), in order to insert with an axial translation movement said containers (2) into the respective holding elements (24) attached to said second conveyor (25).

2) A device as claimed in claim 1 wherein said first (7) and third (22) rotary elements include a respective wheel (6, 26) of said first and second conveyors (3, 25) placed at a higher level.

3) A device as claimed in claim 1 wherein each of said conveyors (3, 25) is a chain conveyor.

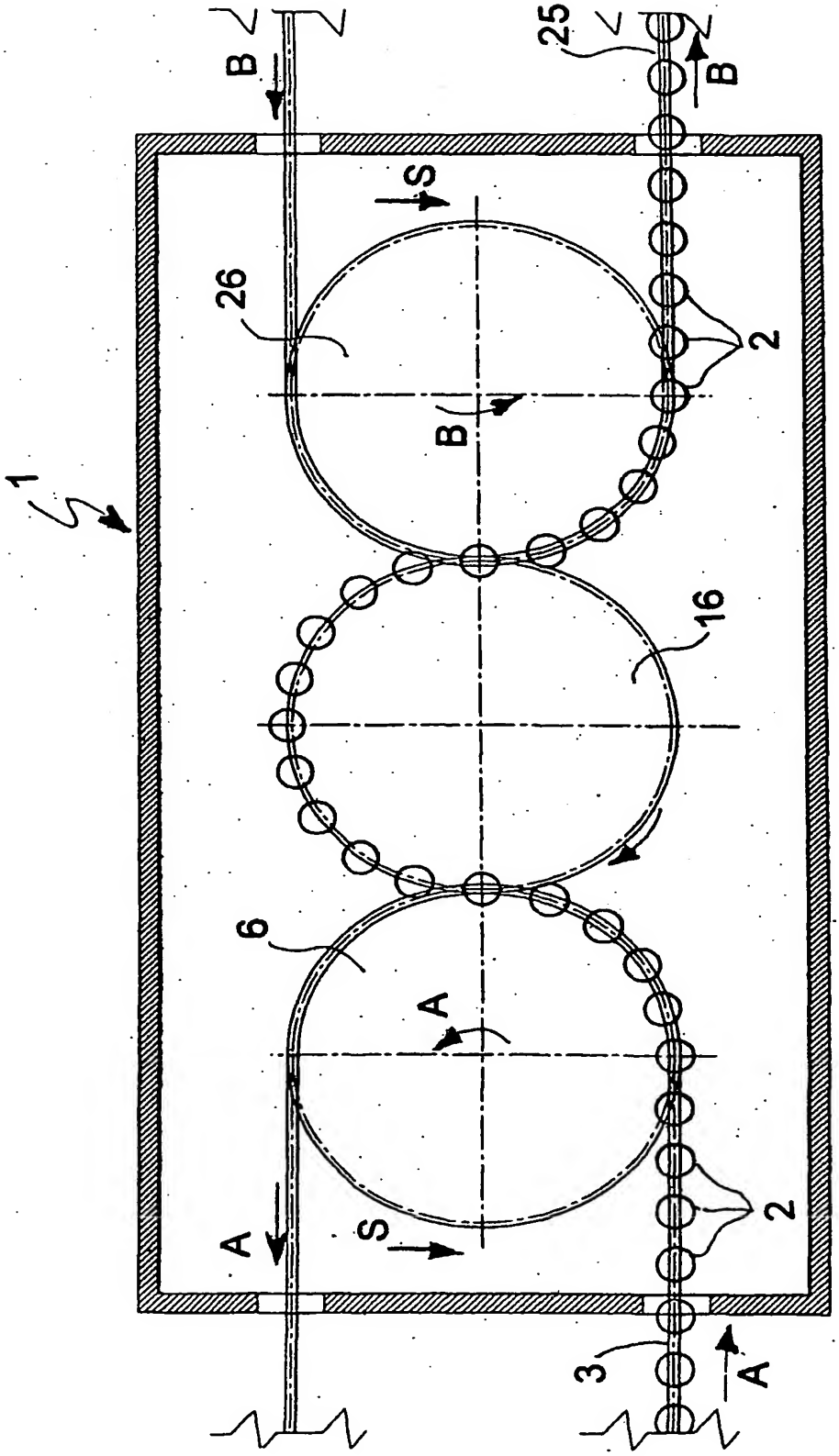

Fig. 1

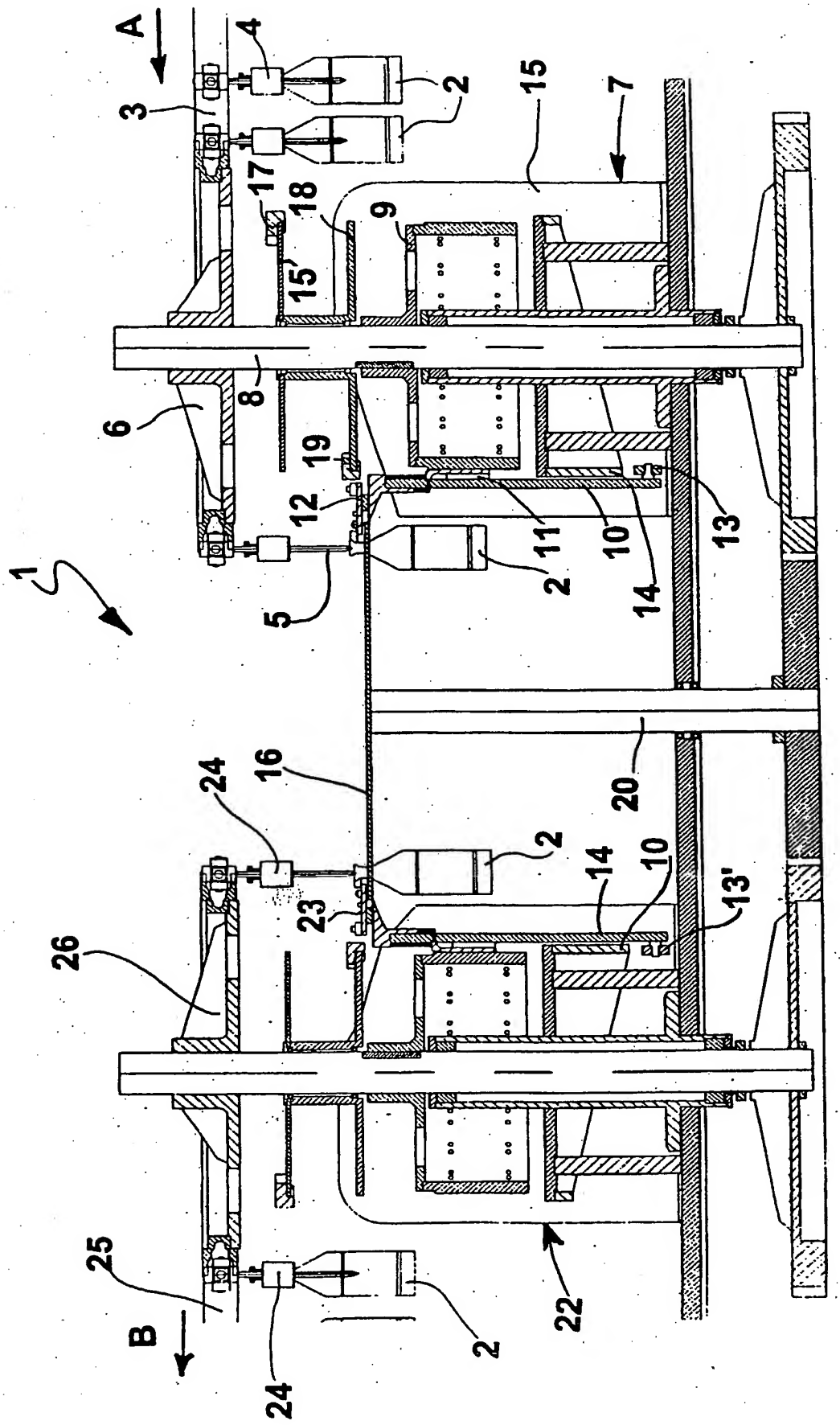

Fig. 2

INTERNATIONAL SEARCH REPORT

Internati plication No
PCT/EP 03/02095

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65G29/00 B65G47/84

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65G B29C A22C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 195 12 515 A (MELEGARI SPA) 9 May 1996 (1996-05-09) column 2, line 3 -column 3, line 43; figures	1,3
A	FR 2 564 443 A (SAINT GOBAIN EMBALLAGE) 22 November 1985 (1985-11-22) claims; figures	1-3
A	GB 854 458 A (RADIO STEEL & MFG CO) 16 November 1960 (1960-11-16) page 2, line 23 - line 116; figures	1-3
A	US 5 344 360 A (HAZENBROEK JACOBUS E) 6 September 1994 (1994-09-06) column 4, line 1 -column 5, line 68; figures	1-3

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Van Rolleghem, F

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna plication No
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